DataSet_Analyiss

Paweł Gędłek, Andrzej Szaflarski

13 06 2020

Fifa17 dataset

https://www.kaggle.com/artimous/complete-fifa-2017-player-dataset-global?select=FullData.csv

Content:

- 17,000+ players
- 50+ attributes per player ranging from ball skills aggression etc.
- Player's attributes sourced from EA Sports' FIFA video game series, including the weekly updates
- Players from all around the globe
- URLs to their homepage
- Club logos
- Player images male and female
- National and club team data

Columns:

- 'Name'
- 'Nationality'
- 'National_Position'
- 'National_Kit'
- 'Club'
- 'Club_Position'
- 'Club_Kit'
- 'Club_Joining'
- 'Contract_Expiry'
- 'Rating'
- 'Height'
- 'Weight'
- 'Preffered_Foot'
- 'Birth_Date'
- 'Age'
- 'Preffered_Position'
- 'Work_Rate'
- 'Weak_foot'
- 'Skill_Moves'
- 'Ball_Control'
- 'Dribbling'
- 'Marking'
- 'Sliding_Tackle'
- 'Standing_Tackle'
- 'Aggression'
- 'Reactions'
- 'Attacking_Position'
- 'Interceptions'
- 'Vision'
- 'Composure'
- 'Crossing'
- 'Short_Pass'
- 'Long_Pass'
- 'Acceleration'
- 'Speed'
- 'Stamina'
- 'Strength'
- 'Balance'
- 'Agility'
- 'Jumping'
- 'Heading'
- 'Shot_Power'

- ‘Finishing’
- ‘Long_Shots’
- ‘Curve’
- ‘Freekick_Accuracy’
- ‘Penalties’
- ‘Volleys’
- ‘GK_Positioning’
- ‘GK_Diving’
- ‘GK_Kicking’
- ‘GK_Handling’
- ‘GK_Reflexes’

Początkowo dane należało wyczyścić: m.in.: - dodać kolumny z skonwertowanymi danymi stringowymi na integery za pomocą techniki onehot encoding,

```
Fifa <- read.csv("Fifa17_ext.csv", header = TRUE, na.strings = "?")
Fifa <- subset(Fifa, select = -c(X))
dim(Fifa)
```

```
## [1] 17588    56
```

```
attach(Fifa)
head(Fifa)
```

```
##                Name Nationality           Club Club_Position Club_Kit
## 1 Cristiano Ronaldo    Portugal    Real Madrid            LW        7
## 2      Lionel Messi   Argentina   FC Barcelona            RW       10
## 3             Neymar      Brazil   FC Barcelona            LW       11
## 4      Luis SuÃ\241rez     Uruguay   FC Barcelona            ST        9
## 5      Manuel Neuer     Germany      FC Bayern            GK        1
## 6             De Gea       Spain Manchester Utd            GK        1
##   Club_Joining Contract_Expiry Rating Height Weight Preffered_Foot Birth_Date
## 1   07/01/2009            2021     94    185     80          Right 02/05/1985
## 2   07/01/2004            2018     93    170     72           Left 06/24/1987
## 3   07/01/2013            2021     92    174     68          Right 02/05/1992
## 4   07/11/2014            2021     92    182     85          Right 01/24/1987
## 5   07/01/2011            2021     92    193     92          Right 03/27/1986
## 6   07/01/2011            2019     90    193     82          Right 11/07/1990
##   Age Preffered_Position       Work_Rate Weak_foot Skill_Moves Ball_Control
## 1  32              LW/ST      High / Low         4           5           93
## 2  29                 RW Medium / Medium         4           4           95
## 3  25                 LW   High / Medium         5           5           95
## 4  30                 ST   High / Medium         4           4           91
## 5  31                 GK Medium / Medium         4           1           48
## 6  26                 GK Medium / Medium         3           1           31
##   Dribbling Marking Sliding_Tackle Standing_Tackle Aggression Reactions
## 1        92      22             23              31         63        96
## 2        97      13             26              28         48        95
## 3        96      21             33              24         56        88
## 4        86      30             38              45         78        93
## 5        30      10             11              10         29        85
## 6        13      13             13              21         38        88
##   Attacking_Position Interceptions Vision Composure Crossing Short_Pass
## 1                 94            29     85        86       84         83
## 2                 93            22     90        94       77         88
## 3                 90            36     80        80       75         81
## 4                 92            41     84        83       77         83
## 5                 12            30     70        70       15         55
## 6                 12            30     68        60       17         31
##   Long_Pass Acceleration Speed Stamina Strength Balance Agility Jumping Heading
## 1        77           91    92      92       80      63      90      95      85
## 2        87           92    87      74       59      95      90      68      71
## 3        75           93    90      79       49      82      96      61      62
## 4        64           88    77      89       76      60      86      69      77
## 5        59           58    61      44       83      35      52      78      25
## 6        32           56    56      25       64      43      57      67      21
##   Shot_Power Finishing Long_Shots Curve Freekick_Accuracy Penalties Volleys
## 1         92        93         90    81                76        85      88
## 2         85        95         88    89                90        74      85
## 3         78        89         77    79                84        81      83
## 4         87        94         86    86                84        85      88
## 5         25        13         16    14                11        47      11
## 6         31        13         12    21                19        40      13
##   GK_Positioning GK_Diving GK_Kicking GK_Handling GK_Reflexes
## 1             14         7         15          11          11
## 2             14         6         15          11           8
## 3             15         9         15           9          11
## 4             33        27         31          25          37
## 5             91        89         95          90          89
## 6             86        88         87          85          90
##   Nationality_encoded Club_encoded Preffered_Foot_encoded
## 1                 121          456                     1
## 2                   5          200                     0
## 3                  19          200                     1
## 4                 154          200                     1
## 5                  58          202                     1
## 6                 137          358                     1
##   Preffered_Position_encoded Work_Rate_encoded
## 1                        171                1
## 2                        236                8
## 3                        156                2
## 4                        265                2
## 5                        112                8
## 6                        112                8
```

Regresja liniowa

Prosta regresja liniowa

Z użyciem prostej regresji liniowej sprawdźmy jaki wpływ ma wiek zawodnika na jego ogólną ocenę.

```
lmFitSimple <- lm(Rating ~ Age, data = Fifa)
summary(lmFitSimple)
```

```
##
## Call:
## lm(formula = Rating ~ Age, data = Fifa)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -36.105  -4.234  -0.234   3.927  26.153
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 48.50813    0.26258  184.74   <2e-16 ***
## Age          0.69355    0.01014   68.38   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 6.296 on 17586 degrees of freedom
## Multiple R-squared:   0.21,  Adjusted R-squared:   0.21
## F-statistic:  4675 on 1 and 17586 DF,  p-value: < 2.2e-16
```

Możemy sprawdzić poszczególne składowe modelu liniowego.

```
lmFitSimple$coefficients
```

```
## (Intercept)         Age
##  48.5081295   0.6935525
```

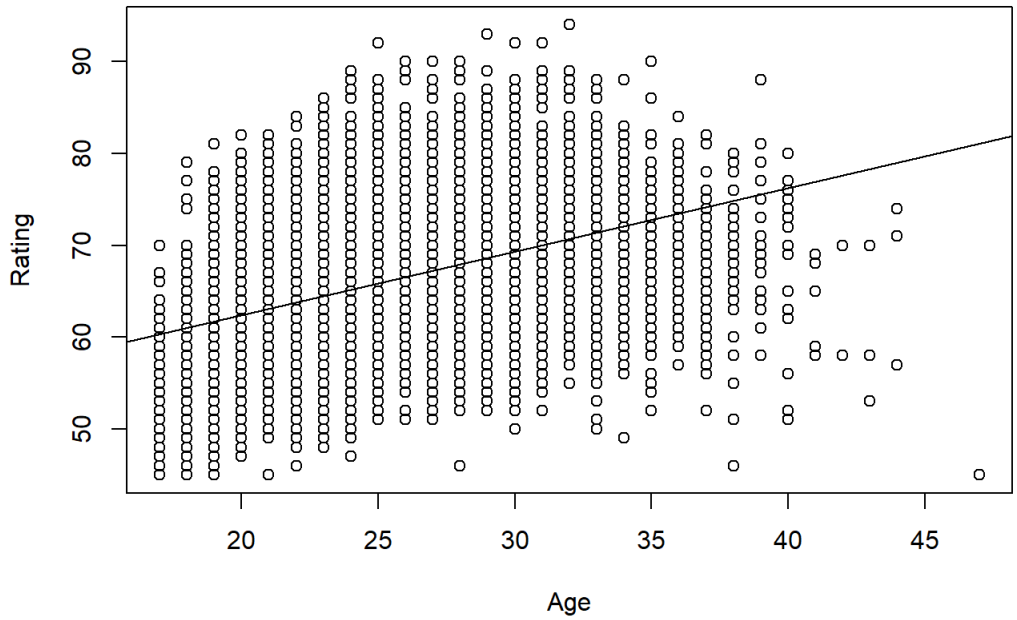
Następnie za pomocą funkcji predict() obliczamy przedziały ufności predykcji przewidujące średnie wartości

```
predict(lmFitSimple, data.frame(Age = c(5, 10, 15)), interval = "confidence")
```

```
##        fit      lwr      upr
## 1 51.97589 51.55860 52.39319
## 2 55.44365 55.12250 55.76481
## 3 58.91142 58.68358 59.13925
```

Prosta regresja liniowa na tle danych

```
plot(Age, Rating)
abline(lmFitSimple)
```



Regresja wielokrotna

```
lmFit.many <- lm(Rating ~ Nationality_encoded + Club_encoded + Club_Kit + Height + Weight + Preffered_Foo
t_encoded + Age + Preffered_Position_encoded)
summary(lmFit.many)
```

```
##
## Call:
## lm(formula = Rating ~ Nationality_encoded + Club_encoded + Club_Kit +
##     Height + Weight + Preffered_Foot_encoded + Age + Preffered_Position_encoded)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -35.539  -4.197  -0.242   3.890  26.287
##
## Coefficients:
##                             Estimate Std. Error t value Pr(>|t|)
## (Intercept)                52.0602600  1.5237360  34.166  < 2e-16 ***
## Nationality_encoded        -0.0002375  0.0009915  -0.240 0.810706
## Club_encoded                0.0009958  0.0002586   3.850 0.000118 ***
## Club_Kit                   -0.0304748  0.0025172 -12.107  < 2e-16 ***
## Height                     -0.0382841  0.0110374  -3.469 0.000524 ***
## Weight                      0.0699714  0.0108771   6.433 1.28e-10 ***
## Preffered_Foot_encoded     -0.6478522  0.1123011  -5.769 8.11e-09 ***
## Age                         0.6496982  0.0106364  61.082  < 2e-16 ***
## Preffered_Position_encoded  0.0006514  0.0005685   1.146 0.251899
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 6.252 on 17578 degrees of freedom
##   (1 observation deleted due to missingness)
## Multiple R-squared:  0.221,  Adjusted R-squared:  0.2206
## F-statistic: 623.2 on 8 and 17578 DF,  p-value: < 2.2e-16
```

Nieliniowe transformacje predyktorów

```
lmFit5 <- lm(Rating ~ poly(Age, 5))
summary(lmFit5)
```

```
##
## Call:
## lm(formula = Rating ~ poly(Age, 5))
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -23.3309  -3.8664  -0.4751   3.5722  24.4661
##
## Coefficients:
##                 Estimate Std. Error  t value Pr(>|t|)
## (Intercept)     66.16619    0.04498 1470.929  < 2e-16 ***
## poly(Age, 5)1  430.46835    5.96558   72.159  < 2e-16 ***
## poly(Age, 5)2 -261.43378    5.96558  -43.824  < 2e-16 ***
## poly(Age, 5)3   47.07163    5.96558    7.891 3.18e-15 ***
## poly(Age, 5)4   -9.82544    5.96558   -1.647   0.0996 .
## poly(Age, 5)5  -25.49126    5.96558   -4.273 1.94e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.966 on 17582 degrees of freedom
## Multiple R-squared:  0.2908, Adjusted R-squared:  0.2906
## F-statistic:  1442 on 5 and 17582 DF,  p-value: < 2.2e-16
```

```
anova(lmFitSimple, lmFit5)
```

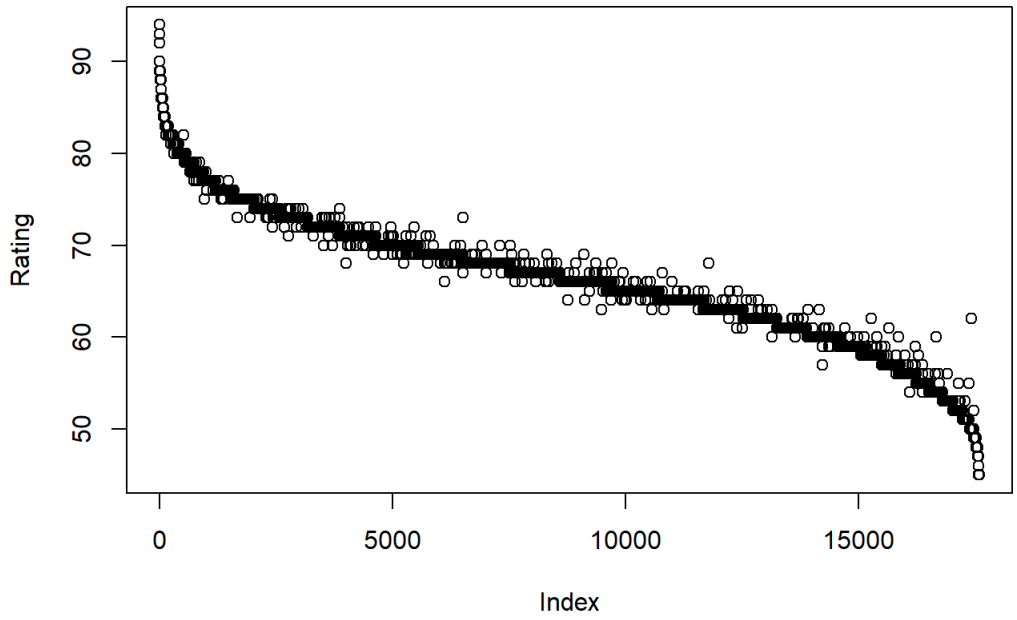
```
## Analysis of Variance Table
##
## Model 1: Rating ~ Age
## Model 2: Rating ~ poly(Age, 5)
##   Res.Df    RSS Df Sum of Sq      F    Pr(>F)
## 1  17586 697020
## 2  17582 625711  4     71310 500.94 < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Klasyfikacja

TODO:

Bardziej skomplikowaną klasyfiklacje

```
plot(Rating)
```




```
fit.logistic <- glm(Preffered_Foot_encoded ~ Preffered_Position_encoded + Work_Rate_encoded + Nationality
_encoded + Volleys + Penalties + Freekick_Accuracy, family = binomial, data = Fifa)
summary(fit.logistic)
```

```
##
## Call:
## glm(formula = Preffered_Foot_encoded ~ Preffered_Position_encoded +
##     Work_Rate_encoded + Nationality_encoded + Volleys + Penalties +
##     Freekick_Accuracy, family = binomial, data = Fifa)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.2616   0.4938   0.6384   0.7536   1.2470
##
## Coefficients:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)                1.4340759  0.0916233  15.652  < 2e-16 ***
## Preffered_Position_encoded 0.0009535  0.0002447   3.896 9.78e-05 ***
## Work_Rate_encoded          0.0206624  0.0067721   3.051  0.00228 **
## Nationality_encoded        0.0010190  0.0003799   2.682  0.00731 **
## Volleys                    0.0113252  0.0019479   5.814 6.10e-09 ***
## Penalties                  0.0091009  0.0021529   4.227 2.37e-05 ***
## Freekick_Accuracy         -0.0334104  0.0017073 -19.569  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 19087  on 17587  degrees of freedom
## Residual deviance: 18506  on 17581  degrees of freedom
## AIC: 18520
##
## Number of Fisher Scoring iterations: 4
```

```
probs.logistic <- predict(fit.logistic, type = "response")
head(probs.logistic)
```

```
##         1         2         3         4         5         6
## 0.7255330 0.6126944 0.6257871 0.7002957 0.8754540 0.8484157
```

```
pred.logistic <- ifelse(probs.logistic > 0.5, 1, 0)
conf.logistic <- table(pred.logistic, Preffered_Foot_encoded)
conf.logistic
```

```
##              Preffered_Foot_encoded
## pred.logistic     0     1
##             0    11    14
##             1  4083 13480
```

```
(conf.logistic[1, 2] + conf.logistic[2, 1]) / sum(conf.logistic)
```

```
## [1] 0.2329429
```

```
mean(pred.logistic != Preffered_Foot_encoded)
```

```
## [1] 0.2329429
```

```
n = dim(Fifa)[1]
train = 1:n/2
Fifa.test = Fifa[(n/2+1):n,]
Preffered_Foot_encoded.test = Preffered_Foot_encoded[(n/2+1):n]
```

```
fit.logistic <- glm(Preffered_Foot_encoded ~ Preffered_Position_encoded + Work_Rate_encoded + Nationality
_encoded + Volleys + Penalties + Freekick_Accuracy, family = binomial, data = Fifa,subset = train)
summary(fit.logistic)
```

```
##
## Call:
## glm(formula = Preffered_Foot_encoded ~ Preffered_Position_encoded +
##     Work_Rate_encoded + Nationality_encoded + Volleys + Penalties +
##     Freekick_Accuracy, family = binomial, data = Fifa, subset = train)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.2536   0.4388   0.6508   0.7875   1.2957
##
## Coefficients:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                 1.4120677  0.0896710  15.747  < 2e-16 ***
## Preffered_Position_encoded  0.0008073  0.0002385   3.384 0.000713 ***
## Work_Rate_encoded           0.0137356  0.0063518   2.162 0.030581 *
## Nationality_encoded         0.0010518  0.0003655   2.878 0.004001 **
## Volleys                     0.0111503  0.0017520   6.364 1.96e-10 ***
## Penalties                   0.0127002  0.0020212   6.284 3.31e-10 ***
## Freekick_Accuracy          -0.0347229  0.0016083 -21.590  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 19578  on 17586  degrees of freedom
## Residual deviance: 18945  on 17580  degrees of freedom
## AIC: 18959
##
## Number of Fisher Scoring iterations: 4
```

```
probs.logistic <- predict(fit.logistic, Fifa.test, type = "response")
pred.logistic <- ifelse(probs.logistic > 0.5, 1, 0)
table(pred.logistic, Preffered_Foot_encoded.test)
```

```
##              Preffered_Foot_encoded.test
## pred.logistic    0    1
##             0    2    2
##             1 1939 6851
```

```
fit.logistic <- glm(Preffered_Foot_encoded ~ Volleys + Penalties + Freekick_Accuracy, family = binomial,
data = Fifa,subset = train)
summary(fit.logistic)
```

```
##
## Call:
## glm(formula = Preffered_Foot_encoded ~ Volleys + Penalties +
##     Freekick_Accuracy, family = binomial, data = Fifa, subset = train)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.2529   0.4446   0.6518   0.7890   1.3170
##
## Coefficients:
##                    Estimate Std. Error z value Pr(>|z|)
## (Intercept)        1.647697   0.065406  25.192  < 2e-16 ***
## Volleys            0.012381   0.001670   7.414 1.23e-13 ***
## Penalties          0.013174   0.002005   6.570 5.03e-11 ***
## Freekick_Accuracy -0.036150   0.001544 -23.407  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 19578  on 17586  degrees of freedom
## Residual deviance: 18968  on 17583  degrees of freedom
## AIC: 18976
##
## Number of Fisher Scoring iterations: 4
```

```
probs.logistic <- predict(fit.logistic, Fifa.test, type = "response")
pred.logistic <- ifelse(probs.logistic > 0.5, 1, 0)
table(pred.logistic, Preffered_Foot_encoded.test)
```

```
##              Preffered_Foot_encoded.test
## pred.logistic    0    1
##             0    2    5
##             1 1939 6848
```

LDA

```
fit.lda <- lda(Preffered_Foot_encoded ~ Volleys + Penalties + Freekick_Accuracy, data = Fifa, subset = tr
ain)
fit.lda
```

```
## Call:
## lda(Preffered_Foot_encoded ~ Volleys + Penalties + Freekick_Accuracy,
##     data = Fifa, subset = train)
##
## Prior probabilities of groups:
##         0         1
## 0.2448399 0.7551601
##
## Group means:
##    Volleys Penalties Freekick_Accuracy
## 0 49.76173  54.71760          54.03623
## 1 48.34576  53.17491          47.72193
##
## Coefficients of linear discriminants:
##                            LD1
## Volleys            0.02910998
## Penalties          0.02879298
## Freekick_Accuracy -0.08282276
```

```
pred.lda <- predict(fit.lda, Fifa.test)
table(pred.lda$class, Preffered_Foot_encoded.test)
```

```
##    Preffered_Foot_encoded.test
##        0    1
##   0    2    5
##   1 1939 6848
```

```
max(pred.lda$posterior[, 2])
```

```
## [1] 0.9273505
```

```
max(pred.lda$posterior[, 1])
```

```
## [1] 0.527549
```

QDA

```
fit.qda <- qda(Preffered_Foot_encoded ~ Volleys + Penalties + Freekick_Accuracy, data = Fifa, subset = tr
ain)
fit.qda
```

```
## Call:
## qda(Preffered_Foot_encoded ~ Volleys + Penalties + Freekick_Accuracy,
##     data = Fifa, subset = train)
##
## Prior probabilities of groups:
##         0         1
## 0.2448399 0.7551601
##
## Group means:
##    Volleys Penalties Freekick_Accuracy
## 0 49.76173  54.71760          54.03623
## 1 48.34576  53.17491          47.72193
```

```
pred.qda <- predict(fit.qda, Fifa.test)
table(pred.qda$class, Preffered_Foot_encoded.test)
```

```
##    Preffered_Foot_encoded.test
##        0    1
##   0    7    7
##   1 1934 6846
```

kNN

```
train.set <- Fifa[1:(n/2), c("Volleys", "Freekick_Accuracy")]
test.set <- Fifa[(n/2 + 1):n, c("Volleys", "Freekick_Accuracy")]
Preffered_Foot_encoded.train <- Preffered_Foot_encoded[1:(n/2)]
pred.knn.1 <- knn(train.set, test.set, Preffered_Foot_encoded.train, k = 1)
table(pred.knn.1, Preffered_Foot_encoded.test)
```

```
##           Preffered_Foot_encoded.test
## pred.knn.1    0    1
##          0  325  925
##          1 1616 5928
```

```
mean(pred.knn.1[1:8793] != Preffered_Foot_encoded.test[1:8793])
```

```
## [1] 0.2889799
```

Selekcja cech dla modeli liniowych

```
fit.bs <- regsubsets(Rating ~ . - (Name + Nationality + Club + Club_Position + Club_Joining + Birth_Date
+ Preffered_Foot + Preffered_Position + Work_Rate), data = Fifa, nvmax = 46)
summary(fit.bs)
```

```
## Subset selection object
## Call: regsubsets.formula(Rating ~ . - (Name + Nationality + Club +
##     Club_Position + Club_Joining + Birth_Date + Preffered_Foot +
##     Preffered_Position + Work_Rate), data = Fifa, nvmax = 46)
## 46 Variables  (and intercept)
##                            Forced in Forced out
## Club_Kit                       FALSE      FALSE
## Contract_Expiry                FALSE      FALSE
## Height                         FALSE      FALSE
## Weight                         FALSE      FALSE
## Age                            FALSE      FALSE
## Weak_foot                      FALSE      FALSE
## Skill_Moves                    FALSE      FALSE
## Ball_Control                   FALSE      FALSE
## Dribbling                      FALSE      FALSE
## Marking                        FALSE      FALSE
## Sliding_Tackle                 FALSE      FALSE
## Standing_Tackle                FALSE      FALSE
## Aggression                     FALSE      FALSE
## Reactions                      FALSE      FALSE
## Attacking_Position             FALSE      FALSE
## Interceptions                  FALSE      FALSE
## Vision                         FALSE      FALSE
## Composure                      FALSE      FALSE
## Crossing                       FALSE      FALSE
## Short_Pass                     FALSE      FALSE
## Long_Pass                      FALSE      FALSE
## Acceleration                   FALSE      FALSE
## Speed                          FALSE      FALSE
## Stamina                        FALSE      FALSE
## Strength                       FALSE      FALSE
## Balance                        FALSE      FALSE
## Agility                        FALSE      FALSE
## Jumping                        FALSE      FALSE
## Heading                        FALSE      FALSE
## Shot_Power                     FALSE      FALSE
## Finishing                      FALSE      FALSE
## Long_Shots                     FALSE      FALSE
## Curve                          FALSE      FALSE
## Freekick_Accuracy              FALSE      FALSE
## Penalties                      FALSE      FALSE
## Volleys                        FALSE      FALSE
## GK_Positioning                 FALSE      FALSE
## GK_Diving                      FALSE      FALSE
## GK_Kicking                     FALSE      FALSE
## GK_Handling                    FALSE      FALSE
## GK_Reflexes                    FALSE      FALSE
## Nationality_encoded            FALSE      FALSE
## Club_encoded                   FALSE      FALSE
## Preffered_Foot_encoded         FALSE      FALSE
## Preffered_Position_encoded     FALSE      FALSE
## Work_Rate_encoded              FALSE      FALSE
## 1 subsets of each size up to 46
## Selection Algorithm: exhaustive
##           Club_Kit Contract_Expiry Height Weight Age Weak_foot Skill_Moves
## 1  ( 1 )  " "      " "             " "    " "    " " " "       " "
## 2  ( 1 )  " "      " "             " "    " "    " " " "       " "
## 3  ( 1 )  " "      " "             " "    " "    " " " "       " "
## 4  ( 1 )  " "      " "             " "    " "    " " " "       " "
## 5  ( 1 )  " "      " "             " "    " "    " " " "       " "
## 6  ( 1 )  " "      " "             " "    " "    " " " "       " "
## 7  ( 1 )  " "      " "             " "    " "    " " " "       "*"
## 8  ( 1 )  " "      " "             " "    " "    " " " "       "*"
## 9  ( 1 )  " "      " "             " "    " "    " " " "       "*"
## 10  ( 1 ) " "      " "             " "    " "    " " " "       "*"
## 11  ( 1 ) " "      " "             " "    " "    " " " "       "*"
## 12  ( 1 ) " "      " "             " "    " "    " " " "       "*"
## 13  ( 1 ) " "      " "             " "    " "    " " " "       "*"
```

```
## 13  ( 1 ) " "       " "             " "     " "     " " " " "       "*"
## 14  ( 1 ) " "       " "             " "     " "     " " " " "       "*"
## 15  ( 1 ) " "       " "             " "     " "     "*" " " "       "*"
## 16  ( 1 ) " "       " "             " "     " "     "*" " " "       "*"
## 17  ( 1 ) " "       " "             " "     " "     "*" " " "       "*"
## 18  ( 1 ) " "       " "             " "     " "     "*" " " "       "*"
## 19  ( 1 ) " "       " "             " "     " "     "*" " " "       "*"
## 20  ( 1 ) " "       " "             " "     " "     "*" " " "       "*"
## 21  ( 1 ) " "       " "             " "     " "     "*" " " "       "*"
## 22  ( 1 ) " "       " "             " "     " "     "*" " " "       "*"
## 23  ( 1 ) " "       " "             " "     " "     "*" " " "       "*"
## 24  ( 1 ) " "       " "             " "     " "     "*" " " "       "*"
## 25  ( 1 ) " "       " "             " "     " "     "*" " " "       "*"
## 26  ( 1 ) " "       " "             " "     " "     "*" " " "       "*"
## 27  ( 1 ) " "       "*"             " "     " "     "*" " " "       "*"
## 28  ( 1 ) "*"       "*"             " "     " "     "*" " " "       "*"
## 29  ( 1 ) "*"       "*"             " "     "*"     "*" " " "       "*"
## 30  ( 1 ) "*"       "*"             " "     "*"     "*" " " "       "*"
## 31  ( 1 ) "*"       "*"             " "     "*"     "*" " " "       "*"
## 32  ( 1 ) "*"       "*"             " "     "*"     "*" " " "       "*"
## 33  ( 1 ) "*"       "*"             " "     "*"     "*" "*" "       "*"
## 34  ( 1 ) "*"       "*"             " "     "*"     "*" "*" "       "*"
## 35  ( 1 ) "*"       "*"             " "     "*"     "*" "*" "       "*"
## 36  ( 1 ) "*"       "*"             " "     "*"     "*" "*" "       "*"
## 37  ( 1 ) "*"       "*"             " "     "*"     "*" "*" "       "*"
## 38  ( 1 ) "*"       "*"             " "     "*"     "*" "*" "       "*"
## 39  ( 1 ) "*"       "*"             " "     "*"     "*" "*" "       "*"
## 40  ( 1 ) "*"       "*"             "*"     "*"     "*" "*" "       "*"
## 41  ( 1 ) "*"       "*"             "*"     "*"     "*" "*" "       "*"
## 42  ( 1 ) "*"       "*"             "*"     "*"     "*" "*" "       "*"
## 43  ( 1 ) "*"       "*"             "*"     "*"     "*" "*" "       "*"
## 44  ( 1 ) "*"       "*"             "*"     "*"     "*" "*" "       "*"
## 45  ( 1 ) "*"       "*"             "*"     "*"     "*" "*" "       "*"
## 46  ( 1 ) "*"       "*"             "*"     "*"     "*" "*" "       "*"
##           Ball_Control Dribbling Marking Sliding_Tackle Standing_Tackle
## 1   ( 1 )  " "          " "       " "     " "           " "
## 2   ( 1 )  " "          " "       " "     " "           " "
## 3   ( 1 )  "*"          " "       " "     " "           " "
## 4   ( 1 )  "*"          " "       " "     " "           " "
## 5   ( 1 )  "*"          " "       " "     " "           "*"
## 6   ( 1 )  "*"          " "       " "     " "           "*"
## 7   ( 1 )  "*"          " "       " "     " "           "*"
## 8   ( 1 )  "*"          " "       " "     " "           "*"
## 9   ( 1 )  "*"          " "       " "     " "           "*"
## 10  ( 1 )  "*"          " "       " "     " "           "*"
## 11  ( 1 )  "*"          " "       " "     " "           "*"
## 12  ( 1 )  "*"          " "       " "     " "           "*"
## 13  ( 1 )  "*"          " "       " "     " "           "*"
## 14  ( 1 )  "*"          " "       " "     " "           "*"
## 15  ( 1 )  "*"          " "       " "     " "           "*"
## 16  ( 1 )  "*"          " "       " "     " "           "*"
## 17  ( 1 )  "*"          " "       " "     " "           "*"
## 18  ( 1 )  "*"          " "       " "     " "           "*"
## 19  ( 1 )  "*"          " "       " "     " "           "*"
## 20  ( 1 )  "*"          " "       " "     " "           "*"
## 21  ( 1 )  "*"          " "       " "     " "           "*"
## 22  ( 1 )  "*"          " "       " "     " "           "*"
## 23  ( 1 )  "*"          " "       " "     " "           "*"
## 24  ( 1 )  "*"          " "       " "     " "           "*"
## 25  ( 1 )  "*"          " "       " "     " "           "*"
## 26  ( 1 )  "*"          " "       " "     " "           "*"
## 27  ( 1 )  "*"          " "       " "     " "           "*"
## 28  ( 1 )  "*"          " "       " "     " "           "*"
## 29  ( 1 )  "*"          " "       " "     " "           "*"
## 30  ( 1 )  "*"          " "       " "     " "           "*"
## 31  ( 1 )  "*"          " "       " "     " "           "*"
## 32  ( 1 )  "*"          "*"       " "     " "           "*"
## 33  ( 1 )  "*"          "*"       " "     " "           "*"
## 34  ( 1 )  "*"          "*"       " "     " "           "*"
## 35  ( 1 )  "*"          "*"       " "     " "           "*"
## 36  ( 1 )  "*"          "*"       "*"     "*"           "*"
## 37  ( 1 )  "*"          "*"       "*"     "*"           "*"
## 38  ( 1 )  "*"          "*"       "*"     "*"           "*"
```

```
## 39  ( 1 ) "*"          "*"       "*"     "*"            "*"
## 40  ( 1 ) "*"          "*"       "*"     "*"            "*"
## 41  ( 1 ) "*"          "*"       "*"     "*"            "*"
## 42  ( 1 ) "*"          "*"       "*"     "*"            "*"
## 43  ( 1 ) "*"          "*"       "*"     "*"            "*"
## 44  ( 1 ) "*"          "*"       "*"     "*"            "*"
## 45  ( 1 ) "*"          "*"       "*"     "*"            "*"
## 46  ( 1 ) "*"          "*"       "*"     "*"            "*"
##           Aggression Reactions Attacking_Position Interceptions Vision
## 1   ( 1 )  " "        "*"       " "                " "           " "
## 2   ( 1 )  " "        "*"       " "                " "           " "
## 3   ( 1 )  " "        "*"       " "                " "           " "
## 4   ( 1 )  " "        "*"       " "                " "           " "
## 5   ( 1 )  " "        "*"       " "                " "           " "
## 6   ( 1 )  " "        "*"       " "                " "           " "
## 7   ( 1 )  " "        "*"       " "                " "           " "
## 8   ( 1 )  " "        "*"       " "                " "           " "
## 9   ( 1 )  " "        "*"       " "                " "           " "
## 10  ( 1 ) " "        "*"       " "                " "           " "
## 11  ( 1 ) " "        "*"       " "                " "           " "
## 12  ( 1 ) " "        "*"       " "                " "           " "
## 13  ( 1 ) " "        "*"       " "                " "           " "
## 14  ( 1 ) " "        "*"       "*"                " "           " "
## 15  ( 1 ) " "        "*"       "*"                " "           " "
## 16  ( 1 ) " "        "*"       "*"                " "           " "
## 17  ( 1 ) " "        "*"       "*"                " "           " "
## 18  ( 1 ) " "        "*"       "*"                " "           " "
## 19  ( 1 ) " "        "*"       "*"                " "           " "
## 20  ( 1 ) " "        "*"       "*"                " "           " "
## 21  ( 1 ) " "        "*"       "*"                " "           " "
## 22  ( 1 ) " "        "*"       "*"                " "           " "
## 23  ( 1 ) " "        "*"       "*"                " "           " "
## 24  ( 1 ) " "        "*"       "*"                " "           " "
## 25  ( 1 ) " "        "*"       "*"                " "           " "
## 26  ( 1 ) " "        "*"       "*"                " "           " "
## 27  ( 1 ) " "        "*"       "*"                " "           " "
## 28  ( 1 ) " "        "*"       "*"                " "           " "
## 29  ( 1 ) " "        "*"       "*"                " "           " "
## 30  ( 1 ) " "        "*"       "*"                " "           " "
## 31  ( 1 ) " "        "*"       "*"                " "           " "
## 32  ( 1 ) " "        "*"       "*"                " "           " "
## 33  ( 1 ) " "        "*"       "*"                " "           " "
## 34  ( 1 ) " "        "*"       "*"                " "           " "
## 35  ( 1 ) " "        "*"       "*"                " "           "*"
## 36  ( 1 ) " "        "*"       "*"                " "           " "
## 37  ( 1 ) " "        "*"       "*"                " "           "*"
## 38  ( 1 ) "*"        "*"       "*"                " "           "*"
## 39  ( 1 ) "*"        "*"       "*"                " "           "*"
## 40  ( 1 ) "*"        "*"       "*"                " "           "*"
## 41  ( 1 ) "*"        "*"       "*"                " "           "*"
## 42  ( 1 ) "*"        "*"       "*"                "*"           "*"
## 43  ( 1 ) "*"        "*"       "*"                "*"           "*"
## 44  ( 1 ) "*"        "*"       "*"                "*"           "*"
## 45  ( 1 ) "*"        "*"       "*"                "*"           "*"
## 46  ( 1 ) "*"        "*"       "*"                "*"           "*"
##           Composure Crossing Short_Pass Long_Pass Acceleration Speed Stamina
## 1   ( 1 )  " "       " "      " "        " "       " "          " "   " "
## 2   ( 1 )  "*"       " "      " "        " "       " "          " "   " "
## 3   ( 1 )  " "       " "      " "        " "       " "          " "   " "
## 4   ( 1 )  " "       " "      " "        " "       " "          " "   " "
## 5   ( 1 )  " "       " "      " "        " "       " "          " "   " "
## 6   ( 1 )  " "       " "      " "        " "       " "          " "   " "
## 7   ( 1 )  " "       " "      " "        " "       " "          " "   " "
## 8   ( 1 )  " "       " "      " "        " "       " "          " "   " "
## 9   ( 1 )  " "       " "      " "        " "       " "          "*"   " "
## 10  ( 1 ) "*"       " "      " "        " "       " "          "*"   " "
## 11  ( 1 ) "*"       " "      " "        " "       " "          "*"   " "
## 12  ( 1 ) "*"       " "      "*"        " "       " "          "*"   " "
## 13  ( 1 ) "*"       " "      "*"        " "       " "          "*"   " "
## 14  ( 1 ) "*"       " "      "*"        " "       " "          "*"   " "
## 15  ( 1 ) "*"       " "      "*"        " "       " "          "*"   " "
## 16  ( 1 ) "*"       " "      "*"        " "       " "          "*"   " "
## 17  ( 1 ) "*"       " "      "*"        " "       "*"          "*"   " "
```

```
## 18  ( 1 ) "*"       " "       "*"       " "       "*"          "*"   " "
## 19  ( 1 ) "*"       " "       "*"       " "       "*"          "*"   " "
## 20  ( 1 ) "*"       " "       "*"       " "       "*"          "*"   " "
## 21  ( 1 ) "*"       " "       "*"       " "       "*"          "*"   " "
## 22  ( 1 ) "*"       "*"       "*"       " "       "*"          "*"   " "
## 23  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   " "
## 24  ( 1 ) "*"       "*"       "*"       " "       "*"          "*"   " "
## 25  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   " "
## 26  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   " "
## 27  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   " "
## 28  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   " "
## 29  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   " "
## 30  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   " "
## 31  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   "*"
## 32  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   "*"
## 33  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   "*"
## 34  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   "*"
## 35  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   "*"
## 36  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   "*"
## 37  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   "*"
## 38  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   "*"
## 39  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   "*"
## 40  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   "*"
## 41  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   "*"
## 42  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   "*"
## 43  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   "*"
## 44  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   "*"
## 45  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   "*"
## 46  ( 1 ) "*"       "*"       "*"       "*"       "*"          "*"   "*"
##           Strength Balance Agility Jumping Heading Shot_Power Finishing
## 1   ( 1 )  " "       " "      " "      " "      " "      " "         " "
## 2   ( 1 )  " "       " "      " "      " "      " "      " "         " "
## 3   ( 1 )  " "       " "      " "      " "      " "      " "         " "
## 4   ( 1 )  " "       " "      " "      " "      "*"      " "         " "
## 5   ( 1 )  " "       " "      " "      " "      "*"      " "         " "
## 6   ( 1 )  " "       " "      " "      " "      "*"      " "         " "
## 7   ( 1 )  " "       " "      " "      " "      "*"      " "         " "
## 8   ( 1 )  "*"       " "      " "      " "      "*"      " "         " "
## 9   ( 1 )  "*"       " "      " "      " "      "*"      " "         " "
## 10  ( 1 ) "*"       " "      " "      " "      "*"      " "         " "
## 11  ( 1 ) "*"       " "      " "      " "      "*"      " "         " "
## 12  ( 1 ) "*"       " "      " "      " "      "*"      " "         " "
## 13  ( 1 ) "*"       " "      " "      " "      "*"      " "         " "
## 14  ( 1 ) "*"       " "      " "      " "      "*"      " "         " "
## 15  ( 1 ) "*"       " "      " "      " "      "*"      " "         " "
## 16  ( 1 ) "*"       " "      " "      " "      "*"      " "         " "
## 17  ( 1 ) "*"       " "      " "      " "      "*"      " "         " "
## 18  ( 1 ) "*"       "*"      " "      " "      "*"      " "         " "
## 19  ( 1 ) "*"       "*"      " "      " "      "*"      "*"         " "
## 20  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         " "
## 21  ( 1 ) "*"       "*"      " "      "*"      "*"      " "         "*"
## 22  ( 1 ) "*"       "*"      " "      "*"      "*"      " "         "*"
## 23  ( 1 ) "*"       "*"      " "      "*"      "*"      " "         "*"
## 24  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 25  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 26  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 27  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 28  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 29  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 30  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 31  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 32  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 33  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 34  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 35  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 36  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 37  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 38  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 39  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 40  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 41  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 42  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
## 43  ( 1 ) "*"       "*"      " "      "*"      "*"      "*"         "*"
```

```
## 43  ( 1 ) "*"       "*"       " "       "*"       "*"       "*"          "*"
## 44  ( 1 ) "*"       "*"       " "       "*"       "*"       "*"          "*"
## 45  ( 1 ) "*"       "*"       "*"       "*"       "*"       "*"          "*"
## 46  ( 1 ) "*"       "*"       "*"       "*"       "*"       "*"          "*"
##           Long_Shots Curve Freekick_Accuracy Penalties Volleys GK_Positioning
## 1  ( 1 )  " "        " "   " "                " "       " "     " "
## 2  ( 1 )  " "        " "   " "                " "       " "     " "
## 3  ( 1 )  " "        " "   " "                " "       " "     "*"
## 4  ( 1 )  " "        " "   " "                " "       " "     " "
## 5  ( 1 )  " "        " "   " "                " "       " "     " "
## 6  ( 1 )  " "        " "   " "                " "       " "     " "
## 7  ( 1 )  " "        " "   " "                " "       " "     " "
## 8  ( 1 )  " "        " "   " "                " "       " "     " "
## 9  ( 1 )  " "        " "   " "                " "       " "     " "
## 10  ( 1 ) " "        " "   " "                " "       " "     " "
## 11  ( 1 ) " "        " "   " "                " "       " "     "*"
## 12  ( 1 ) " "        " "   " "                " "       " "     "*"
## 13  ( 1 ) " "        " "   " "                " "       " "     "*"
## 14  ( 1 ) " "        " "   " "                " "       " "     "*"
## 15  ( 1 ) " "        " "   " "                " "       " "     "*"
## 16  ( 1 ) " "        " "   " "                " "       " "     "*"
## 17  ( 1 ) " "        " "   " "                " "       " "     "*"
## 18  ( 1 ) " "        " "   " "                " "       " "     "*"
## 19  ( 1 ) " "        " "   " "                " "       " "     "*"
## 20  ( 1 ) " "        " "   " "                " "       " "     "*"
## 21  ( 1 ) " "        " "   " "                " "       " "     "*"
## 22  ( 1 ) " "        " "   " "                " "       " "     "*"
## 23  ( 1 ) " "        " "   " "                " "       " "     "*"
## 24  ( 1 ) "*"        " "   " "                " "       " "     "*"
## 25  ( 1 ) "*"        " "   " "                " "       " "     "*"
## 26  ( 1 ) "*"        " "   " "                " "       " "     "*"
## 27  ( 1 ) "*"        " "   " "                " "       " "     "*"
## 28  ( 1 ) "*"        " "   " "                " "       " "     "*"
## 29  ( 1 ) "*"        " "   " "                " "       " "     "*"
## 30  ( 1 ) "*"        " "   " "                " "       " "     "*"
## 31  ( 1 ) "*"        " "   " "                " "       " "     "*"
## 32  ( 1 ) "*"        " "   " "                " "       " "     "*"
## 33  ( 1 ) "*"        " "   " "                " "       " "     "*"
## 34  ( 1 ) "*"        "*"   " "                " "       " "     "*"
## 35  ( 1 ) "*"        "*"   " "                " "       " "     "*"
## 36  ( 1 ) "*"        "*"   " "                " "       " "     "*"
## 37  ( 1 ) "*"        "*"   " "                " "       " "     "*"
## 38  ( 1 ) "*"        "*"   " "                " "       " "     "*"
## 39  ( 1 ) "*"        "*"   " "                " "       "*"     "*"
## 40  ( 1 ) "*"        "*"   " "                " "       "*"     "*"
## 41  ( 1 ) "*"        "*"   " "                " "       "*"     "*"
## 42  ( 1 ) "*"        "*"   " "                " "       "*"     "*"
## 43  ( 1 ) "*"        "*"   "*"                " "       "*"     "*"
## 44  ( 1 ) "*"        "*"   "*"                "*"       "*"     "*"
## 45  ( 1 ) "*"        "*"   "*"                "*"       "*"     "*"
## 46  ( 1 ) "*"        "*"   "*"                "*"       "*"     "*"
##           GK_Diving GK_Kicking GK_Handling GK_Reflexes Nationality_encoded
## 1  ( 1 )  " "       " "        " "         " "         " "
## 2  ( 1 )  " "       " "        " "         " "         " "
## 3  ( 1 )  " "       " "        " "         " "         " "
## 4  ( 1 )  " "       " "        " "         "*"         " "
## 5  ( 1 )  " "       " "        " "         "*"         " "
## 6  ( 1 )  " "       " "        "*"         "*"         " "
## 7  ( 1 )  " "       " "        "*"         "*"         " "
## 8  ( 1 )  " "       " "        "*"         "*"         " "
## 9  ( 1 )  " "       " "        "*"         "*"         " "
## 10  ( 1 ) " "       " "        "*"         "*"         " "
## 11  ( 1 ) " "       " "        "*"         "*"         " "
## 12  ( 1 ) " "       " "        "*"         "*"         " "
## 13  ( 1 ) "*"       " "        "*"         "*"         " "
## 14  ( 1 ) "*"       " "        "*"         "*"         " "
## 15  ( 1 ) "*"       " "        "*"         "*"         " "
## 16  ( 1 ) "*"       " "        "*"         "*"         " "
## 17  ( 1 ) "*"       " "        "*"         "*"         " "
## 18  ( 1 ) "*"       " "        "*"         "*"         " "
## 19  ( 1 ) "*"       " "        "*"         "*"         " "
## 20  ( 1 ) "*"       " "        "*"         "*"         " "
## 21  ( 1 ) "*"       " "        "*"         "*"         " "
```

```
## 22  ( 1 ) "*"       " "        "*"         "*"         " "
## 23  ( 1 ) "*"       " "        "*"         "*"         " "
## 24  ( 1 ) "*"       " "        "*"         "*"         " "
## 25  ( 1 ) "*"       " "        "*"         "*"         " "
## 26  ( 1 ) "*"       "*"        "*"         "*"         " "
## 27  ( 1 ) "*"       "*"        "*"         "*"         " "
## 28  ( 1 ) "*"       "*"        "*"         "*"         " "
## 29  ( 1 ) "*"       "*"        "*"         "*"         " "
## 30  ( 1 ) "*"       "*"        "*"         "*"         " "
## 31  ( 1 ) "*"       "*"        "*"         "*"         " "
## 32  ( 1 ) "*"       "*"        "*"         "*"         " "
## 33  ( 1 ) "*"       "*"        "*"         "*"         " "
## 34  ( 1 ) "*"       "*"        "*"         "*"         " "
## 35  ( 1 ) "*"       "*"        "*"         "*"         " "
## 36  ( 1 ) "*"       "*"        "*"         "*"         " "
## 37  ( 1 ) "*"       "*"        "*"         "*"         " "
## 38  ( 1 ) "*"       "*"        "*"         "*"         " "
## 39  ( 1 ) "*"       "*"        "*"         "*"         " "
## 40  ( 1 ) "*"       "*"        "*"         "*"         " "
## 41  ( 1 ) "*"       "*"        "*"         "*"         " "
## 42  ( 1 ) "*"       "*"        "*"         "*"         " "
## 43  ( 1 ) "*"       "*"        "*"         "*"         " "
## 44  ( 1 ) "*"       "*"        "*"         "*"         " "
## 45  ( 1 ) "*"       "*"        "*"         "*"         " "
## 46  ( 1 ) "*"       "*"        "*"         "*"         "*"
##           Club_encoded Preffered_Foot_encoded Preffered_Position_encoded
## 1   ( 1 )  " "          " "                    " "
## 2   ( 1 )  " "          " "                    " "
## 3   ( 1 )  " "          " "                    " "
## 4   ( 1 )  " "          " "                    " "
## 5   ( 1 )  " "          " "                    " "
## 6   ( 1 )  " "          " "                    " "
## 7   ( 1 )  " "          " "                    " "
## 8   ( 1 )  " "          " "                    " "
## 9   ( 1 )  " "          " "                    " "
## 10  ( 1 ) " "          " "                    " "
## 11  ( 1 ) " "          " "                    " "
## 12  ( 1 ) " "          " "                    " "
## 13  ( 1 ) " "          " "                    " "
## 14  ( 1 ) " "          " "                    " "
## 15  ( 1 ) " "          " "                    " "
## 16  ( 1 ) " "          " "                    " "
## 17  ( 1 ) " "          " "                    " "
## 18  ( 1 ) " "          " "                    " "
## 19  ( 1 ) " "          " "                    " "
## 20  ( 1 ) " "          " "                    " "
## 21  ( 1 ) " "          " "                    "*"
## 22  ( 1 ) " "          " "                    "*"
## 23  ( 1 ) " "          " "                    "*"
## 24  ( 1 ) " "          " "                    "*"
## 25  ( 1 ) " "          " "                    "*"
## 26  ( 1 ) " "          " "                    "*"
## 27  ( 1 ) " "          " "                    "*"
## 28  ( 1 ) " "          " "                    "*"
## 29  ( 1 ) " "          " "                    "*"
## 30  ( 1 ) " "          "*"                    "*"
## 31  ( 1 ) " "          "*"                    "*"
## 32  ( 1 ) " "          "*"                    "*"
## 33  ( 1 ) " "          "*"                    "*"
## 34  ( 1 ) " "          "*"                    "*"
## 35  ( 1 ) " "          "*"                    "*"
## 36  ( 1 ) " "          "*"                    "*"
## 37  ( 1 ) " "          "*"                    "*"
## 38  ( 1 ) " "          "*"                    "*"
## 39  ( 1 ) " "          "*"                    "*"
## 40  ( 1 ) " "          "*"                    "*"
## 41  ( 1 ) "*"          "*"                    "*"
## 42  ( 1 ) "*"          "*"                    "*"
## 43  ( 1 ) "*"          "*"                    "*"
## 44  ( 1 ) "*"          "*"                    "*"
## 45  ( 1 ) "*"          "*"                    "*"
## 46  ( 1 ) "*"          "*"                    "*"
##           Work Rate encoded
```

```
## 1  ( 1 )  " "
## 2  ( 1 )  " "
## 3  ( 1 )  " "
## 4  ( 1 )  " "
## 5  ( 1 )  " "
## 6  ( 1 )  " "
## 7  ( 1 )  " "
## 8  ( 1 )  " "
## 9  ( 1 )  " "
## 10  ( 1 ) " "
## 11  ( 1 ) " "
## 12  ( 1 ) " "
## 13  ( 1 ) " "
## 14  ( 1 ) " "
## 15  ( 1 ) " "
## 16  ( 1 ) "*"
## 17  ( 1 ) "*"
## 18  ( 1 ) "*"
## 19  ( 1 ) "*"
## 20  ( 1 ) "*"
## 21  ( 1 ) "*"
## 22  ( 1 ) "*"
## 23  ( 1 ) "*"
## 24  ( 1 ) "*"
## 25  ( 1 ) "*"
## 26  ( 1 ) "*"
## 27  ( 1 ) "*"
## 28  ( 1 ) "*"
## 29  ( 1 ) "*"
## 30  ( 1 ) "*"
## 31  ( 1 ) "*"
## 32  ( 1 ) "*"
## 33  ( 1 ) "*"
## 34  ( 1 ) "*"
## 35  ( 1 ) "*"
## 36  ( 1 ) "*"
## 37  ( 1 ) "*"
## 38  ( 1 ) "*"
## 39  ( 1 ) "*"
## 40  ( 1 ) "*"
## 41  ( 1 ) "*"
## 42  ( 1 ) "*"
## 43  ( 1 ) "*"
## 44  ( 1 ) "*"
## 45  ( 1 ) "*"
## 46  ( 1 ) "*"
```

```
fit.bs.summary <- summary(fit.bs)
fit.bs.summary$cp
```

```
##  [1] 18234.30473 15484.08798 11176.01024  6867.18297  5558.41348  4472.00388
##  [7]  3722.62801  2935.37777  2380.75077  1819.65950  1376.86198  1131.34033
## [13]   964.29745   833.10019   680.37833   593.88012   546.68197   499.10202
## [19]   456.79364   415.25800   374.72403   334.04022   296.91256   258.40823
## [25]   223.45571   186.91630   158.04029   136.51353   116.40004   103.82958
## [31]    93.77632    84.13763    75.90994    68.95863    63.48245    57.50740
## [37]    52.63902    48.47215    45.23005    44.31754    43.80642    43.60585
## [43]    43.89061    43.67975    45.04866    47.00000
```

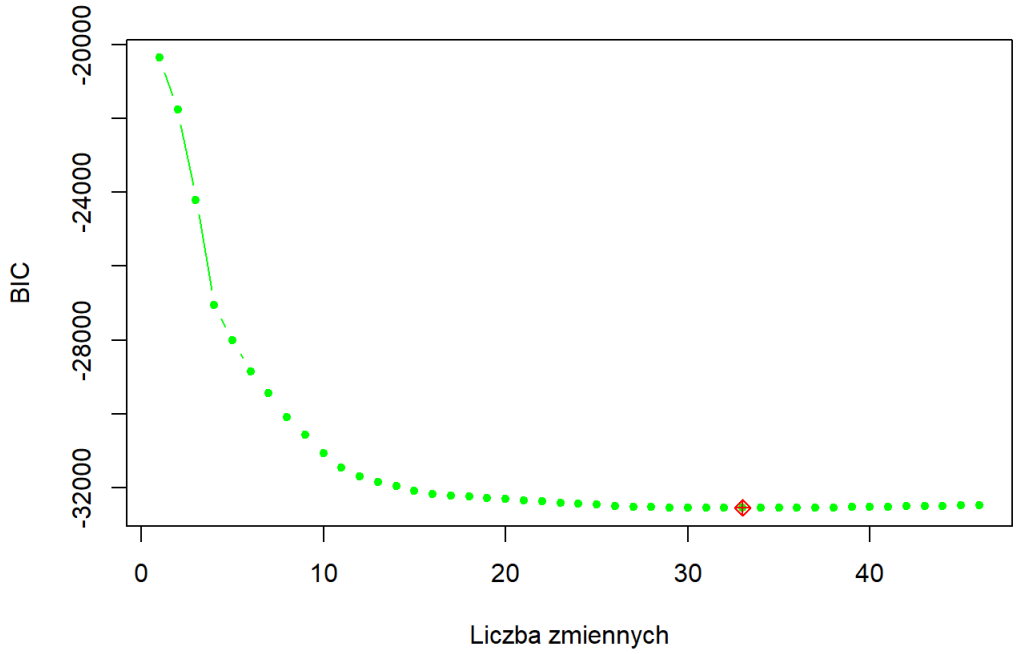
```
bic.min <- which.min(fit.bs.summary$bic)
bic.min
```

```
## [1] 33
```

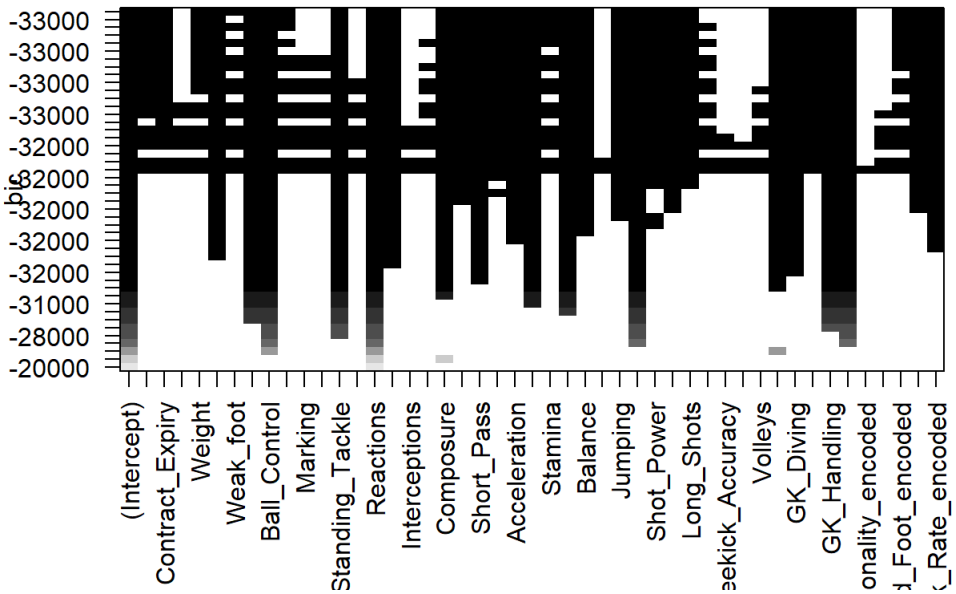
```
fit.bs.summary$bic[bic.min]
```

```
## [1] -32548.19
```

```
plot(fit.bs.summary$bic, xlab = "Liczba zmiennych", ylab = "BIC", col = "green",
     type = "b", pch = 20)
points(bic.min, fit.bs.summary$bic[bic.min], col = "red", pch = 9)
```




```
plot(fit.bs, scale = "bic")
```




```
coef(fit.bs, id = 6)
```

```
##      (Intercept)     Ball_Control Standing_Tackle       Reactions         Heading
##      14.16940753       0.26906431       0.04794444       0.35353142       0.12813456
##      GK_Handling     GK_Reflexes
##       0.16970715       0.16343786
```

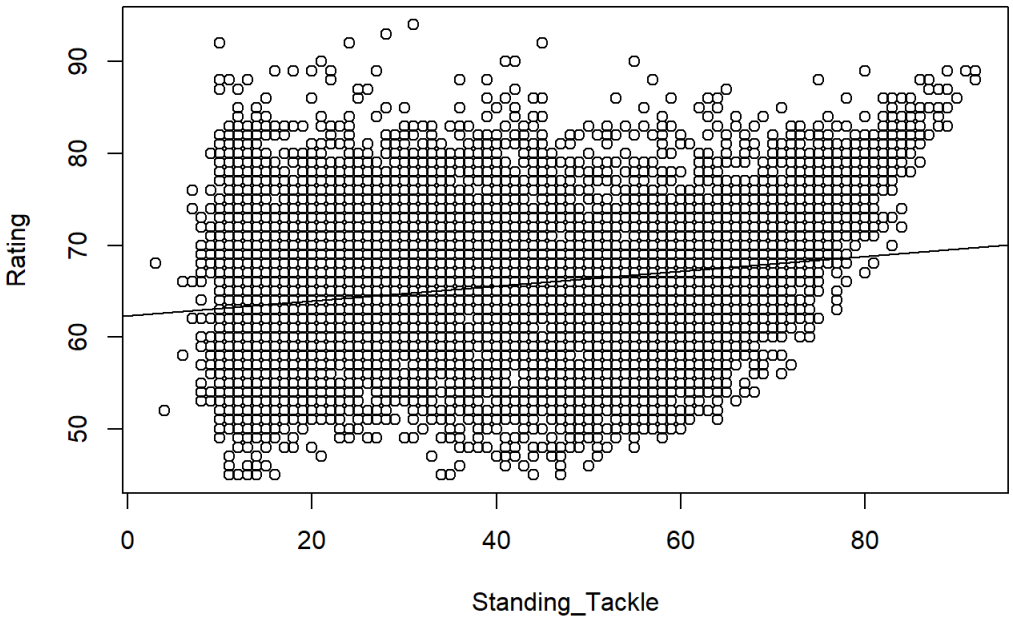
```
lmFit.many <- lm(Rating ~ Ball_Control + Standing_Tackle + Reactions + Heading + GK_Handling + GK_Reflexe
s)
summary(lmFit.many)
```

```
##
## Call:
## lm(formula = Rating ~ Ball_Control + Standing_Tackle + Reactions +
##     Heading + GK_Handling + GK_Reflexes)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -16.9149  -2.0465  -0.0067   2.0179  15.9982
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)     14.168943   0.202836   69.85   <2e-16 ***
## Ball_Control     0.269066   0.002988   90.04   <2e-16 ***
## Standing_Tackle  0.047942   0.001373   34.93   <2e-16 ***
## Reactions        0.353534   0.003686   95.92   <2e-16 ***
## Heading          0.128140   0.002312   55.42   <2e-16 ***
## GK_Handling      0.169705   0.005760   29.46   <2e-16 ***
## GK_Reflexes      0.163443   0.005469   29.88   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.113 on 17581 degrees of freedom
## Multiple R-squared:  0.8069, Adjusted R-squared:  0.8068
## F-statistic: 1.224e+04 on 6 and 17581 DF,  p-value: < 2.2e-16
```

```
lmFit.Standing_Tackle <- lm(Rating ~ Standing_Tackle, data = Fifa)
summary(lmFit.Standing_Tackle)
```

```
##
## Call:
## lm(formula = Rating ~ Standing_Tackle, data = Fifa)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -21.1305  -4.4235   0.0514   4.5159  29.1624
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)     62.33242    0.12376   503.7   <2e-16 ***
## Standing_Tackle  0.08081    0.00237    34.1   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 6.86 on 17586 degrees of freedom
## Multiple R-squared:  0.06202,    Adjusted R-squared:  0.06197
## F-statistic:  1163 on 1 and 17586 DF,  p-value: < 2.2e-16
```

```
plot(Standing_Tackle, Rating)
abline(lmFit.Standing_Tackle)
```


Rating
50
60
70
80
90
0
20
40
60
80
Standing_Tackle